

BARITE

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Barite production for 2002 was 420,000 metric tons (t), a 5% increase from that of 2001. Domestic production and sales data for barite were derived from voluntary responses to the U.S. Geological Survey (USGS) canvass of U.S. operations and followup telephone calls. All of the 34 known operations responded.

Barite, a name that was derived from the Greek word “barus” (heavy), is the mineralogical name for barium sulfate. In commerce, the mineral is sometimes referred to as “barytes.” As used in this report, the term “primary barite” refers to the first marketable product, which includes crude barite (run of mine) and the products of simple beneficiation methods, such as flotation, heavy media separation, jigging, magnetic separation, tabling, and washing. Most crude barite requires some upgrading to minimum purity or density. Barite that is used as an aggregate in a “heavy” cement is crushed and screened to a uniform size. Most barite is ground to a small uniform size before it is used as a filler or extender, an addition to industrial products, or a weighting agent in petroleum well-drilling mud [American Petroleum Institute (API) or Oil Companies’ Materials Association (OCMA)] specification barite.

Barite used for drilling petroleum wells can be black, blue, brown, buff, or gray depending on the ore body. It must be finely ground so that at least 97% of the material, by weight, can pass through a 200-mesh [75-micrometer (μm)] (Tyler) screen, and no more than 30%, by weight, can be less than 6 μm , effective diameter, which is measured using sedimentation techniques. The ground barite also must be dense enough that its specific gravity is 4.2 or greater, soft enough to not damage the bearings of a tricone drill bit, and both chemically inert and containing no more than 250 milligrams per kilogram (mg/kg) of soluble alkaline salts (American Petroleum Institute, 1993, p. 6-11). A small percentage of iron oxide is allowable.

An additional feature of barite is noninterference with magnetic measurements taken in the borehole, either during logging-while-drilling or in separate drill-hole logging. In offshore drilling, the U.S. Environmental Protection Agency limits the content of mercury to 1 mg/kg of barite and that of cadmium to 3 mg/kg of barite (U.S. Environmental Protection Agency, 1997). Although barite contains a heavy metal (barium), it is not a toxic chemical under section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 because it is very insoluble.

Production

Two barite operations were idle, and 32 were active. Eight mines were included in the survey; six were producing, and two were idle. Of the producing mines, four were in Nevada, and two were in Georgia; there was an idle mine in Tennessee and another in Missouri. There were 26 mills/grinding plants operating for the reporting year. Three grinding plants were in Nevada, all associated with mines but surveyed separately from the mines. Five of the six active mines had associated grinding plants. None of the Nevada-mined ore was sent to the Gulf of Mexico coast for grinding; it was ground onsite and sold into the northwestern U.S. and southwestern Canadian petroleum exploration and development (E&D) market.

The quantity of primary barite sold or used by domestic producers increased by about 5% to 420,000 t from that of 2001 (table 1); weighted average prices increased by about 5%. About 5% of barite sales from domestic producers was for industrial end uses (table 3). The remaining sales were for petroleum-well-drilling API specification markets. Production was solely in Nevada and Georgia.

There were 16 facilities on the Gulf of Mexico coast that produced API-grade barite in 2002. In Louisiana, there was a grinding plant in Houma, two near Lake Charles/Westlake, three grinding plants in Morgan City/Amelia, one in New Iberia, and one near New Orleans. In Texas, there were two plants in Brownsville, three in Corpus Christi, one in Galveston, and two in Houston. One of the plants in Brownsville was owned by Minerales y Arcillas S.A. de C.V. (Minar) of Mexico (Moore, 2002). These stand-alone grinding plants received relatively low-priced crude barite primarily from China and India for grinding to petroleum-well-drilling specifications. Small amounts were ground for filler and extender markets.

There were two stand-alone grinding plants in Illinois and another grinding plant near Dyersburg, TN, producing both filler-and-extender-grade and chemical-grade barite for industry markets using imported, river-barged crude barite. One grinding plant in California, associated with a mine in Nevada, produced filler and extender barite, and one grinding plant in Missouri used material from the stockpile of a nearby idle mine for the same end use. Two grinding plants in Georgia, associated with mines, produced filler-and-extender grade and chemical-grade industrial barite.

Structure of the Mineral Industry

Halliburton Co. owned the Baroid Drilling Fluids Division. A joint venture between Smith International Inc. and Schlumberger Ltd. owned M-I LLC, which was the owner of M-I Drilling Fluids. The third major U.S. barite company was Baker Hughes INTEQ, a division of Baker Hughes, Inc. These three companies mined barite in Nevada with collocated beneficiation plants (mills) and also

operated grinding plants in Louisiana and Texas. Excalibar Minerals Inc. (a division of Newpark Resources, Inc.) was significant in the imported barite grinding industry in Louisiana, Tennessee, and Texas.

These four companies and other smaller companies on the Gulf of Mexico coast received imported barite by ship through Louisiana and Texas ports. This location is closer to the large offshore drilling rigs in the Gulf of Mexico and the clusters of onshore areas of exploration with significant discoveries, expansions of reserves, and significant production in the Petroleum Administration for Defense (PAD) District 3 (where searching for gas and oil is most profitable). The PADs were World War II divisions of the oil producing areas of the United States; these designations continue to be used. After grinding to API specifications, the barite may be transferred directly to containers on barges for delivery to the drilling platforms.

Consumption

Apparent consumption of domestic barite fell by about 33% to about 1.9 million metric tons (Mt) in 2002 from about 2.9 Mt in 2001. Ground barite sales fell by about 26% to less than 2.0 Mt for 2002 from 2.7 Mt.

For 2002, the sales of crusher and grinder operations in Louisiana decreased by about 23%, and the sales of crusher and grinder operations in Texas also decreased by nearly 31% (table 2).

Sales of domestic and imported industrial barite in 2002 decreased by less than 26% (table 3).

Since 1998, the consumption of barite in the United States seems to have been driven more by the demand for natural gas than for oil. The drilling rig count has been more positively responsive to rises in the price of natural gas than to rises in the price of oil in the United States. This appears to be unique to the United States; the rest of the world's drill rig count continues to respond positively to changes in the price of oil.

The unweighted average price of natural gas declined to \$3.19 per million British thermal units from \$3.93 per million British thermal units in 2001, using one price per month and no acknowledgment of the amount of gas sold. The price of natural gas in 2002 in the United States was at its lowest level for the year in February at about \$2.05 per million British thermal units. The natural gas price reached a relative peak early in May of about \$3.70 per million British thermal units, then drifted down to about \$2.90 per million British thermal units, then up to a year's high of about \$4.20 per million British thermal units by November. The gas-directed drill rig count started the year at about 745 rigs and was about 2 months behind the price in the timing of its descent; it was its lowest for the year in April at about 590 rigs. The gas-directed drill rig count trailed the gas price rise, reaching a relative peak of about 715 rigs 2 months after the May price peak. For the rest of the year, the gas-directed drill rig count was consistently above 700 rigs except for August. The gas-directed drill rigs represented about 80% of total drill rigs for the whole year except for August. The domestic drill rig total, oil and gas directed, was never above the January 2002 level of 885 rigs and averaged 835 rigs, while the highest count in 2001 was 1,277 rigs and averaged 1,150 rigs, which was approximately a 27% decline in 2002 compared with 2001. This probably caused the 33% decline in barite consumption that was mentioned above.

For 2002, looking for the economic pressures that may have forced down the usage of drill rigs, preliminary results from John S. Herold, Inc. indicated a continuation of elevated finding and development cost (FDC) for the United States. The FDC is the drilled hole cost, while the reserve replacement cost (RRC) is FDC plus cost of purchasing proven reserves. The 2002 FDC was unchanged at \$9.62 per barrel of oil equivalent, using a preliminary 194 respondent companies, versus \$9.59 per barrel of oil equivalent in 2001 for the complete 2001 response (Herold, undated¹). An earlier publication had reported (for the top 50 U.S. companies) that finding and development spending had dropped by 14% to \$28.5 billion in 2002 (Cacchione and Johnson, 2003, p. 1). The 14% drop in finding and development spending could have caused the 27% drop in drill rigs, leading to the 33% drop in barite consumption.

Trade

Barite imports during 2002 were down by about 39% to more than 1.5 Mt from more than 2.5 Mt (table 1). Barite, as crude ore, is imported in ocean bulk freighters and is transferred to barges for delivery to the grinders. Barite exports increased by about 5% to 47,000 t, or about 11% of domestic sales.

Prices

The average weighted sales value, using unrounded numbers, for primary barite from mines and their associated beneficiation plant (table 1) in the United States was unchanged at about \$28.90 per metric ton in 2002. The average weighted sales value, using unrounded numbers, for the crushed and ground barite for oil well drilling in Louisiana and Texas (table 2) was unchanged at \$79.10 per ton for 2002. The average weighted sales value using unrounded numbers, of the production of the "other" States (table 2) was nearly unchanged at \$64.70 per ton for 2002, but the tonnage declined by about 26%. Barite for other barium chemicals, filler and extender, and glass use (table 3) declined by about 37% to about \$141 per ton for 2002.

According to Industrial Minerals (2002), midyear international barite prices were as follows:

- API, lump, cost, insurance, and freight [U.S.] Gulf Coast, Chinese, \$42 to \$46 per ton; Indian, \$48 to \$50 per ton; Moroccan, \$50 to \$52 per ton.
- Unground, OCMA/API, bulk, specific gravity 4.2, free on board (f.o.b.) Morocco, \$39 to \$41 per ton.

¹A reference that includes a section mark (§) is found in the Internet Reference Cited section.

- Ground, bagged, specific gravity 4.22, f.o.b. Morocco, \$75 to \$85 per ton.
- Ground, OCMA/API, big bags (1.5 tons) f.o.b. South Turkey, \$68 to \$70 per ton.
- Ground, OCMA, bulk, delivered Aberdeen [United Kingdom], \$73.50 to \$80.85 per ton [£50 to £55 per ton] and delivered Great Yarmouth [United Kingdom], \$85.26 to \$95.55 per ton [£58 to £65 per ton].
- Micronized, off white minimum 99% less than 20 μm delivered United Kingdom, \$205.80 to \$220.50 per ton [£140 to £150 per ton].
- Ground, white, paint-grade, 96% to 98% barium sulfate, 350-mesh, 1 to 5 t delivered United Kingdom, \$286.65 to \$323.40 per ton [£195 to £220 per ton].

World Review

According to the world drill rig reports, which do not cover most of countries of the Commonwealth of Independent States, the world drill rig count (with Canadian onshore drill rigs subtracted because their operations are seasonal) fell from about 1,615 rigs in January 2002 to about 1,480 rigs in April and climbed back to about 1,615 rigs in December [Oil & Gas Journal, 2002-2003 (the third issues of each month)]. The average world monthly drill rig count was about 1,570 rigs per month for 2002, down by about 335 rigs per month, about 18%, from the 1,905 rig-per-month count average for 2001.

The John S. Herold, Inc. finding cost “snapshot” for 2002 reported that worldwide FDC was \$7.66 per barrel of oil equivalent, about \$1.86 per barrel of oil equivalent less than the U.S. FDC of \$9.62 per barrel of oil equivalent (Herold, undated\$). The 2002 worldwide FDC value of \$7.66 per barrel of oil equivalent is a significant increase for the worldwide 5-year average, ending in 2000, FDC of \$3.25 per barrel of oil equivalent (Cacchione and Johnson, 2001, p. 8). This publication reported 5-year average, ending in 2000, FDC levels for the “frontier” regions of Africa and the Middle East to be \$2.89 per barrel of oil equivalent, of Asia-Pacific to be \$1.16 per barrel of oil equivalent, and of Latin America to be \$1.90 per barrel of oil equivalent. The issue of rising FDC has a global scope which will have to be understood alongside the United States 2002 FDC of \$9.62 per barrel of oil equivalent.

By regions, in ascending order of drill rig count, which is indicative of regional barite consumption, the following regions had variations in drill rig count according to price, or other influence, as follows:

Africa.—The total average drill rig count for the year 2002 was about 58 rigs per month versus about 53 rigs per month for 2001, up by 9%. This region’s drill rig count climbed from May 1999 until April 2001, when drillers responded to the oil futures price decline that started in December of 2000, indicating a 4-month delay.

Europe.—European average total drill rig count was 88.3 rigs per month for 2002, down by 7% from 95 rigs per month for 2001.

Asia-Pacific.—The Asia-Pacific total drill rig count for 2002 started at 171 rigs in January and finished at 184 rigs in December and the average count of 171 rigs per month; this was up by about 8% from the 2001 average total drill rig count of 158 rigs per month. That region’s drill rig count has been slowly but steadily climbing since bottoming at 121 rigs per month in August 1999.

Middle East.—The average total active drill rig count for 2002 was more than 201 rigs per month, up by about 12% from the average total drill rig count of about 179 rigs per month in 2001. The total drill rig count for the Middle East has risen to 211 rigs in December 2002 from 130 rigs in September 1999.

Latin America.—The average total drill rig count for 2002 was about 213 rigs per month, down by 18% from 261 rigs per month in 2001.

Canada.—The average total drill rig count was 266 rigs per month for 2002, down by 22% from the average 342 rigs per month for 2001. Canada also was an important gas supplier to the United States.

Outlook

In the United States, barite consumption by the natural gas industry is expected to be sustained by the medium-term exploration and development of gas reserves and is expected to be an end use for many years. The minor amounts of industrial barite end uses, such as barite-impregnated rubber, special glass, and fillers and extenders, will probably continue at present levels. Yet the rising cost per barrel of oil equivalent for finding and developing domestic petroleum industry wells may portend the likely decline of barite consumption in North America in the long term.

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TABLE 1
SALIENT BARITE STATISTICS^{1,2}

(Thousand metric tons and thousand dollars)

	1998	1999	2000	2001	2002
United States:					
Barite, primary:					
Sold or used by producers:					
Quantity	476	434	392	400	420
Value	11,400	11,100	9,840	11,000	12,200
Exports:					
Quantity	15	22	36	45	47
Value	2,310	2,750	4,180	5,330	4,230
Imports for consumption: ³					
Quantity	1,890	871	2,100	2,510	1,540
Value	122,000	59,000	108,000	125,000	81,300
Consumption, apparent ⁴	2,350	1,280	2,460	2,870	1,920
Crushed and ground, sold or used by processors: ⁵					
Quantity	1,890	1,370	2,100	2,670	1,980
Value	146,000	108,000	159,000	206,000	151,000
World, production	6,460 ^r	6,160 ^r	6,470 ^r	6,560 ^r	5,960 ^e

^eEstimated. ^rRevised.

¹Data are rounded to no more than three significant digits.

²Barium chemicals data withheld to avoid disclosing company proprietary data.

³Includes crude and ground.

⁴Sold or used plus imports minus exports.

⁵Includes imports.

TABLE 2
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS IN
THE UNITED STATES, BY STATE^{1,2}

State	2001			2002		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	8	1,400	\$110,000	8	1,080	\$82,400
Texas	8	763	62,600	8	526	44,300
Other ³	9	510	33,600	10	380	24,600
Total	25	2,670	206,000	26	1,980	151,000

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes imports.

³Includes California, Georgia, Illinois, Missouri, Nevada, and Tennessee (2001).

TABLE 3
CRUSHED AND GROUND BARITE SOLD OR USED BY
PROCESSORS IN THE UNITED STATES, BY USE^{1, 2}

(Thousand metric tons and thousand dollars)

Use	2001		2002	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	80 ^r	15,500 ^r	103	14,600
Well drilling	2,590 ^r	191,000 ^r	1,880	137,000
Total	2,670	206,000	1,980	151,000

^rRevised

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes imports.

TABLE 4
U.S. EXPORTS OF NATURAL BARIUM SULFATE (BARITE), BY COUNTRY¹

Country	2001		2002	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Angola	--	--	45	\$11
Argentina	40	\$10	--	--
Australia	--	--	37	50
Brazil	17	4	--	--
Canada	39,500	3,410	44,600	3,250
Chad	--	--	185	138
Chile	17	5	--	--
China	1,410	462	32	27
Colombia	--	--	13	4
Costa Rica	106	27	39	9
Ecuador	204	30	18	3
Finland	--	--	62	23
France	--	--	6	4
Germany	--	--	16	32
Iceland	--	--	20	6
Italy	6	19	--	--
Japan	373	121	238	58
Korea, Republic of	10	6	5	3
Mexico	2,480	966	1,720	503
Norway	--	--	16	3
Pakistan	1	5	--	--
Poland	--	--	32	15
Portugal	--	--	10	10
Russia	489	179	--	--
South Africa	2	4	--	--
Switzerland	--	--	3	15
Trinidad and Tobago	27	8	--	--
Turkey	--	--	4	31
United Kingdom	--	--	42	4
Venezuela	135	71	109	37
Total	44,800	5,330	47,200	4,230

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF BARITE, BY COUNTRY¹

Country	2001		2002	
	Quantity (metric tons)	Value ² (thousands)	Quantity (metric tons)	Value ² (thousands)
Barite, crude:				
Canada	185	\$13	--	--
China	2,090,000	86,500	1,380,000	\$57,000
Hong Kong	4,540	198	--	--
India	328,000	18,400	77,000	3,570
Indonesia	34,200	1,580	--	--
Mexico	550	55	--	--
Morocco	17,400	779	47,800	2,510
Total	2,470,000	107,000	1,510,000	63,100
Barite, ground:				
Canada	--	--	22	3
China	5,910	609	5,150	591
Mexico	551	37	--	--
Total	6,460	646	5,170	594
Barite, other sulfates of:				
Australia	--	--	6	32
Belgium	16	31	82	158
Canada	7,210	1,910	552	542
China	14,300	3,140	14,700	3,150
France	--	--	59	39
Germany	8,360	8,020	10,000	9,410
Italy	3,760	2,160	4,180	2,330
Japan	738	1,190	992	1,410
Mexico	--	--	23	8
Netherlands	183	63	--	--
Russia	--	--	91	29
Spain	116	97	172	122
Switzerland	177	228	315	439
Taiwan	42	7	--	--
United Kingdom	163	25	--	--
Total	35,100	16,900	31,200	17,700

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Cost, insurance, and freight value.

Source: U.S. Census Bureau, as adjusted by the U.S. Geological Survey.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF BARIUM CHEMICALS¹

	2001		2002	
	Quantity (metric tons)	Value ² (thousands)	Quantity (metric tons)	Value ² (thousands)
Barium chloride	341	\$291	244	\$122
Barium oxide, hydroxide, peroxide	3,780	3,300	4,710	4,040
Barium nitrate	5,010	6,070	7,470	6,830
Barium carbonate, precipitated	18,600	9,210	18,400	6,030

¹Data are rounded to no more than three significant digits.

²Cost, insurance, and freight value.

Source: U.S. Census Bureau.

TABLE 7
BARITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country	1998	1999	2000	2001	2002 ^c
Afghanistan ^{c,3}	2,000	2,000	2,000	2,000	2,000
Algeria	37,006	50,150	51,925	43,501 ^r	45,000
Argentina	13,500	4,365	4,500 ^e	3,536 ^r	3,005 ^p
Australia ^c	13,000	18,000	20,000	20,000	20,000
Belgium ^c	40,000	30,000	30,000	30,000	30,000
Bolivia	2,500	6,005	3,050	6,253 ^r	6,100
Bosnia and Herzegovina ^{c,4}	2,000	2,000	2,000	2,000	2,000
Brazil, beneficiated	46,632	44,906	53,741	55,000 ^e	55,000
Bulgaria ^{c,5}	100,000 ^r	120,000	120,000	100,000	90,000
Burma	22,004	24,651	30,370	31,015 ^r	20,000
Canada	90,000	123,000	67,000	23,000 ^r	13,000 ⁶
Chile	1,430	823	1,026	584 ^r	600
China ^c	3,300,000	3,500,000	3,500,000	3,600,000	3,100,000
Colombia ^c	600	600	600	600	600
Egypt ^c	300	500	500	500	500
France	75,000 ^e	75,000	75,000	75,000 ^e	75,000
Georgia ^c	20,000	15,000	15,000	15,000	15,000
Germany, marketable Ba ₂ SO ₄ ^c	120,000	120,000 ⁶	120,000	120,000	120,000
Greece, crude ore ^c	800	800	800	800	800
Guatemala ^c	-- ^r	75 ^r	113 ^r	100 ^r	100
India	749,412	360,000 ^e	840,000	850,000 ^e	600,000
Iran ³	187,677	183,850	185,000 ^e	218,000 ^r	220,000
Italy ^c	30,000	25,000	25,000	25,000	25,000
Kazakhstan ⁴	9,000	13,300	14,000 ^e	45,000 ^e	40,000
Kenya	10 ^e	--	--	--	--
Korea, North ^c	100,000	70,000	70,000	70,000	70,000
Korea, Republic of	--	--	30	-- ^e	--
Laos	9,050	7,900	2,000 ^r	1,700 ^r	2,000
Malaysia	1,580 ^e	13,506	7,274	649 ^r	700
Mexico	161,555	157,953	127,420	145,789 ^r	150,000
Morocco	353,438	328,945	320,243	343,557 ^r	471,102 ⁶
Nigeria ^{c,7}	5,000	5,000	5,000	5,000	5,000
Pakistan	20,657	20,505	21,234	22,000 ^e	25,000
Peru	7,506	3,512	11,403	11,031 ^r	11,500
Romania, processed	10,327 ^r	4,641 ^r	4,266 ^r	2,849 ^r	3,000
Russia ^c	60,000	60,000	60,000	60,000	60,000
Saudi Arabia ^c	8,000	7,000	8,000	9,000 ^{r,6}	9,000
Slovakia, concentrate	15,000	16,000	14,000	14,000 ^r	15,000
South Africa	610 ^e	2,844	1,628	-- ^e	--
Spain, marketable Ba ₂ SO ₄	28,000	26,000	26,000	26,000 ^e	26,000
Thailand	105,221	76,092	56,180	23,559 ^r	25,000
Tunisia	8,011	530	3,702	2,208 ^r	5,539 ⁶
Turkey, run-of-mine	160,042	150,058	120,893	100,000 ^e	120,000
United Kingdom	68,000	59,000	55,000	60,000 ^e	60,000
United States ⁸	476,000	434,000	392,000	400,000 ^e	420,000 ⁶
Total	6,460,000 ^r	6,160,000 ^r	6,470,000 ^r	6,560,000 ^r	5,960,000

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through June 10, 2003.

³Data are for fiscal year beginning March 21 of that stated.

⁴Based on an estimated 70% recovery factor.

⁵Barite concentrates.

⁶Reported figure.

⁷Considerably more barite is produced, but its considered to be commercially unusable.

⁸Sold or used by producers.